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Female Gender and HIV Transmission Risk Behaviors among People Living with HIV Who Have Ever Used Injection Drugs in St. Petersburg, Russia

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1. Introduction

Russia's overall disease burden attributable to substance use is one of the highest in the world (1). It is among the top three countries (together with China and the USA) with the largest estimated populations of persons who inject drugs (PWID) (2). Injection drug use is the main driver of HIV transmission in Russia (3, 4), a country where HIV incidence is

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steadily increasing. This same trend is occurring throughout parts of Eastern Europe where substance use is widespread and stands in contrast to the decline or stabilization of HIV incidence currently seen in other parts of the world (5), reflecting a strong relationship between injection drug use and HIV transmission. Estimates from 2017 suggest 30.4% (17.9-43.0%) of all PWID in Russia were living with HIV (6). Despite the country's fast-growing HIV epidemic, access to prevention and harm reduction services, such as needle and syringe exchange programs and opioid agonist treatment are limited and non-existent, respectively (4). Further, available statistics suggest the majority of Russian adults (63%) living with HIV are not on antiretroviral treatment (ART) (7). Numerous barriers prevent access to treatment, including the multiple steps required to enter into HIV care, discrimination towards people living with HIV (PLHIV) overall, and conservative legislation placing restrictions on same-sex and other non-traditional relationships, drug use and sex work (4, 8). Effective, evidence-informed prevention strategies are urgently needed in Russia to prevent both HIV acquisition and transmission. Understanding the country's HIV dynamics and patterns of transmission and acquisition are essential for designing approaches to reach key populations, including PWID and their sexual partners.

Globally, there are more male than female PWID (4) but available data suggest that among PWID, women have a higher HIV prevalence in many settings (9), including Eastern Europe. A 2012 meta-analysis including data collected from 128,745 PWID, drawn from 117 studies in 14 countries (including Russia) found a modest but significantly higher HIV prevalence among female PWID, relative to male PWID (OR=1.18; 95% CI: 1.10-1.26) (10). Many possible explanations exist for elevated risk for HIV infection among women relative to men, irrespective of drug use behaviors. Clear biological mechanisms underlie the differential outcomes of HIV infection in women and men. For example, male-to-female HIV sexual transmission is more efficient than female-to male transmission because HIV-1 infected women have lower infectious potential (11). Additionally, sex hormones in women contribute to enhanced susceptibility by affecting the vaginal mucosa. It is hypothesized that women have lower viral reservoirs (11). It is also widely recognized that sociocultural factors, particularly as they relate to attitudes and practices surrounding sexual behaviors (e.g., norms dictating it is acceptable for men, but not women, to have multiple sex partners) contribute to disparities in HIV infection and transmission between men and women, in the context of heterosexual partnerships. Further, gender-based inequalities (e.g., intimate partner violence; engagement in sex work and/or transactional sex; women's lower wages, compared to men; and less empowerment to negotiate condom use) prevent many women from protecting themselves and/or their partner(s) against HIV infection (10).

Less is known about the elevated risk for HIV infection and transmission among women (relative to men) who inject drugs. It has been found that unsafe injection practices (e.g., sharing used needles) and condomless sex heighten HIV infection risk among all PWID, but evidence suggests women who inject drugs are disproportionately more likely to engage in these behaviors, compared to men (12). Despite these findings, female PWID are often underrepresented in research with drug users and in studies on access to HIV care (12). Evidence-based prevention measures aimed at PWID are urgently needed and have been specifically called for in Russia, where PWID account for the largest proportion of new HIV

diagnoses, relative to any other risk group in the country (13) and where evidence is limited on gender differences in HIV risk behaviors among PLHIV who have ever injected drugs.

A prior study (14) with women who inject drugs in St. Petersburg found 64% were HIV-positive and, in the past year, over 50% had two or more sexual partners, 40% transacted sex, 40% had condomless sex and 40% shared injecting needles. Transactional sex and sexual violence (reported by 12%) were both associated with increased injection drug equipment sharing and violence was associated with increased condomless sex. A second St. Petersburg study (15), conducted with male and female PWID living with HIV found internalized stigma surrounding HIV and drug use was correlated with poorer health outcomes and lower likelihood of service utilization. Although this study did not examine gender differences in these relationships, other research suggests that, compared to men, women who use drugs experience more stigma related to gendered cultural norms which contributes to increased risk for negative HIV outcomes (12).

“Women-specific” research and prevention approaches have been called for to better understand the true context in which drug-using women experience health risks, and to design programs that account for the social, micro, and macro levels of women's lives (12). Further, it is imperative that efforts be placed on developing gender-specific strategies for conducting research and programs to understand and reduce female PWID's risk for both HIV acquisition from (i.e., among HIV-negative PWID) and transmission (i.e., among HIV-positive PWID) to sexual and injection drug use partners. Although a developing body of research informs our ability to design gender-tailored programs to prevent HIV infection among HIV-negative female PWID (e.g., discouraging needle sharing) (14), less is known about how to effectively prevent HIV transmission by HIV-positive PWID to HIV-negative sexual partners or injection drug use partners.

We aimed to assess the association between female gender and drug risk behaviors (e.g., sharing injection drug equipment with others) and sex risk behaviors (e.g., condomless sex) among a population of HIV positive men and women who had ever injected drugs in St. Petersburg, Russia. Recognizing injection drug use as a chronic condition, and that most PWID go through repeated periods of injection cessation and relapses during their injection careers (16, 17), we included participants who reported past month injection drug use and/or injection drug use prior to their HIV-positive diagnosis. Alcohol use prior to sharing injecting equipment and surrounding sex were secondary outcomes in our analysis because alcohol consumption overall (18) including by PLHIV (19) has been associated with significantly higher drug and sex risk behaviors that heighten vulnerability for HIV acquisition, as well as transmission to others (4). Additionally, some of the most risky patterns of drinking (i.e., consuming alcohol at amounts that increase the risk of health or social consequences) (20) have been observed in Russia and Ukraine. Based on what has been found in other studies in Russia and other settings, we hypothesized that among Russian PLHIV who had ever injected drugs, women would have higher odds of engaging in high risk drug use, sexual behaviors, and use of alcohol prior to sex or injecting drugs, relative to men.

2. Methods

2.1 Study Design and Sample Characteristics

This study involved secondary analysis of data from the Russia ARCH cohort, which is part of the three site Uganda, Russia, Boston Alcohol Network for Alcohol Research Collaboration on HIV/AIDS (URBAN ARCH) Consortium. Russia ARCH is an observational prospective cohort study conducted to assess the longitudinal association between alcohol consumption and biomarkers of microbial translocation and inflammation/altered coagulation, which also encompasses a nested randomized controlled trial (ZINC) aimed at assessing the efficacy of zinc supplementation on markers of inflammation.

A sample of 351 Russia ARCH participants were recruited into the study between November 2012 and June 2015 from clinical HIV and addiction care sites, non-clinical sites, and via snowball recruitment in St. Petersburg. Eligibility criteria for inclusion in the cohort included the following: 18-70 years old; documented HIV-infection; documented ART-naïve status; the ability to provide contact information for two contacts to assist with follow-up; stable address within St. Petersburg or districts within 100 kilometers of St. Petersburg; possession of a home or mobile phone. The current analysis was restricted to people who had ever injected drugs, defined as individuals who reported a history of injection drug use prior to HIV diagnosis, or past 30-day injection drug use at study visit. Participants were excluded from the cohort if they were not fluent in Russian or had a cognitive impairment resulting in inability to provide written informed consent. Eligibility was verified and informed consent was obtained. Participants provided a blood sample and were administered an interview assessment. Institutional Review Boards of Boston University Medical Campus and First St. Petersburg Pavlov State Medical University approved this study.

Data for the current analysis come from assessments conducted at baseline, 12- and 24-months post enrollment.

At baseline the following surveys were administered: Demographics (21); Sex Behaviors (22); Sexual Partners; HIV Risk Categories (23); Alcohol 30 Day Timeline Follow Back (24), (25); Drug Use (modified Risk Behavior Survey) (26, 27), (28). The 12- and 24-month ARCH assessments contained the same sections of the baseline assessment with the exception of the HIV Risk Categories section. Most sections of the baseline and follow-up assessments were conducted by trained research assessors, administered in Russian and took between 60 and 90 minutes. Particularly sensitive sections of the assessment (including Sex Behaviors; Sexual Partners; and HIV Risk Categories) were self-administered by the participant.

2.2 Measures

The main independent variable for this study was female gender. Gender was self-reported as male or female. We did not assess other gender categories. The two primary dependent variables of interest were sharing of injecting equipment in the past 30 days and condomless sex in the past 90 days. Condomless sex was defined as vaginal or anal sex (meaning a penis was inserted into the vagina and/or anus) with any sexual partner without the use of a condom or other protective barrier. Three secondary outcomes of interest were also

examined, including alcohol use prior to sharing injecting equipment in past 30 days, alcohol use before or during sex in past 90 days, and reporting of both of the primary dependent variables (i.e., drug equipment sharing [in the past 30 days] and condomless sex [in the past 90 days]).

The following were selected as covariates for inclusion in the adjusted models, due to their potential confounding effects: age, education (less / greater than 9th grade), income (less / greater than the median of the sample), partnered status, and recent ART use at follow-up. We also controlled for recent ART use at follow-up using data from participants' responses to the following question about ART use at the 12 month and 24 month follow-up, “in the last 6 months, have you taken anti-retroviral medications for treating HIV?” Covariates were selected based on clinical knowledge and the literature.

Partnered status was a 3 level covariate with the following categories: not partnered, partnered HIV discordant partner (i.e., uninfected partner), and partnered HIV concordant partner (i.e., HIV-positive partner). There were 21 observations (from 17 unique subjects) over the course of the study (7 at baseline, 9 at 12 months, and 5 at 24 months) whereby a participant reported they did not know the HIV status of their partner. Data from these observations were excluded from the analyses. Partner denoted being married, in a domestic partnership/living with a partner, or in a long-term relationship (duration of marriage or long-term relationship was not measured). Also measured at baseline were median income in Russian Rubles with interquartile range (IQR), mean CD4 count (±5 SD), heroin or other opioid (including codeine, china white, methadone, fentanyl, Krokodil, Khanka) use in past 30 days, and cannabis use in past 30 days. Since measures for past month heroin or opioid use did not distinguish the mode by which the drug was taken, we included data from a question assessing any injection drug use in the past 30 days (yes/no). Those who indicated past 30 day injection drug use were asked to specify the type of drug injected (heroin and stimulants; only heroin; only stimulants; neither heroin nor stimulants). Heavy alcohol use in past 30 days was measured via the 30-day Timeline Followback Method and defined as heavy if meeting NIAAA at-risk drinking amounts (i.e., ≥5 drinks in a day for men and ≥4 drinks in a day for women) (28). Because involvement in transactional sex was associated with injection risk among women in a recent St. Petersburg study (14), we measured whether both male and female participants reported having given sex to a partner, received sex from a partner or both given and received sex to/from a partner in exchange for money, alcohol, drugs, or other things in the past 12 months.

2.3 Statistical Analysis

We assessed baseline frequencies of demographic characteristics, covariates, CD4 count, heroin or other opioid use, any injection drug use (and type of drug injected), cannabis use, heavy alcohol use and transactional sex, overall and by gender. For descriptive purposes, we assessed differences between male and female participants at baseline using chi-square and Fisher's exact tests for categorical variables, and t-tests and Wilcoxon rank-sum tests for continuous variables. We assessed baseline, 12 month and 24 month follow-up frequencies for the primary and secondary outcomes and 12 month and 24 month follow-up frequencies for ART use in the past 6 months. To account for the correlation from using repeated

observations from the same study participants, separate generalized estimating equations (GEE) logistic regression models were used to evaluate the association between gender and each of the binary outcomes controlling for potential confounders. An independence working correlation was used and robust standard errors from the GEE approach are reported. Odds ratios (ORs) and 95% confidence intervals (CIs) are presented from the logistic regression models. Preliminary unadjusted logistic regression models were initially fit for each outcome. We then fit a partially adjusted model controlling only for the demographic covariates specified above (i.e. age, education and income). Lastly, we fit the final, fully adjusted model controlling for demographic covariates and marital/partner status (non-partnered, partnered HIV discordant, partnered HIV concordant) and respondents' reports of ART use in the past 6 months, as recorded at the 12 and 24 month follow-up interviews. A posthoc sensitivity analysis was performed excluding observations from participants who used ARTs. All analysis was done using the statistical package SAS 9.3.

3. Results

At baseline the sample included 291 HIV-positive participants from the Russia ARCH cohort who had ever injected drugs. The mean age at baseline was 33 (SD ±5) years and most participants (75%, 217/291) were male; 25% (74/291) were female and 78% (228/291) had more than a 9th grade education. More men (49%, 107/217) than women (31%, 23/74) were employed. The monthly median income was 20,000 Rubles (IQR: 5,000-30,000), approximately $550 USD at a conversion rate averaged over the time of survey administration (November 2012 – June 2015), and women appeared more likely than men to have earnings below the research sample's median income (68% [50/74] versus 44% [94/217] $p<0.01$). Approximately half of the participants (149/291) were not married or in a partnership; 31% (91/291) were in a concordant relationship with a partner who was living with HIV and 18% (51/291) were in a discordant relationship with an HIV-negative partner. Women were more likely than men to be in an HIV concordant relationship (female: 50% [37/74] vs. male: 25% [54/217]). Men were more likely than women not to be partnered at all (male: 57% [124/217] vs female: 34% [25/74]).

The mean CD4 cell count in this baseline ART-naïve population was 525 (SD ±306). In terms of drug use, 41% (118/291) of respondents reported past 30 day heroin or other opioid use. Injection drug use, specifically, was reported by 44% (127/291), among whom most injected heroin (76%, 96/127), followed by heroin and stimulants (14%, 18/127), stimulants only (8%, 10/127) and neither heroin nor stimulants (2%, 3/127). Cannabis use in the past 30 days was reported by 17% (48/291) and 70% (205/291) reported heavy alcohol use in the past 30 days.

Most participants (86%) reported no form of transactional sex in the past 12 months. The most common transaction was reported by men (14%) as having given money, drugs or alcohol in exchange for sex. We did not measure the type of partner (i.e., regular female partner, same-sex partner, sex worker) involved in this exchange. No women reported giving something for sex and all other forms of transaction were reported by less than 5% of the sample, see Table 1.

Table 2 shows the proportion of participants (overall and by gender) who reported on the primary and secondary outcomes of interest at baseline, 12 and 24-month follow-up. High risk sex behaviors (i.e., condomless sex in the past 90 days and alcohol use before or during sex) were more commonly reported than drug risk behaviors (i.e., sharing drug equipment in the past 30 days and alcohol use prior to sharing). Although Table 2 only descriptively presents the longitudinal frequencies of each outcome, it is noteworthy that – relative to male participants - a higher estimated proportion of female participants reported engaging in every risk behavior at every time point with the exception of past month alcohol use before sharing equipment, as reported at the 12 month follow-up. In general, it appears that there were not substantial changes over time across the various outcomes presented in Table 2. ART use appeared to increase from 12 to 24 months, particularly among men. All participants were ART-naïve at baseline but 17% and 35% reported having taken ART in the past 6 months at the 12 and 24 month follow-up visits, respectively.

Relative to male participants, female participants had significantly higher odds of reporting both primary outcomes, sharing injecting equipment in the past 30 days (OR=1.92; 95% CI: 1.16-3.18, p=0.01) and condomless sex in the past 90 days (OR=2.65; 95% CI: 1.69-4.15, p<0.01) in the unadjusted models. After controlling for demographic covariates, partner status and ART use, the association between female gender and sharing injecting equipment was no longer significant. Female gender remained significantly associated with condomless sex in the past 90 days, even after controlling for demographics (aOR=2.73; 95% CI: 1.67-4.48, p<0.01) and additionally, both partner status and ART use (aOR=1.91; 95% CI: 1.12-3.23, p=0.02), Table 3. The conclusions from posthoc sensitivity analyses excluding observations from participants who used ARTs were consistent with the main analyses for all 5 outcomes (data not shown).

The unadjusted odds of one of the secondary outcomes was higher for female participants than male participants: reporting both drug equipment sharing and condomless sex (OR=3.03; 95% CI: 1.65-5.63, p<0.01). After controlling for demographic covariates, female gender remained statistically significant for the outcome, reporting both injection equipment sharing and condomless sex (OR=2.45; 95% CI: 1.33-4.52, p<0.01). In the final fully adjusted model, where we controlled for demographics as well as the 3 level partner status covariate and ART use, the association between female gender and reporting both injection equipment sharing and condomless sex was no longer significant. No significant association was found in any of the models between female gender and alcohol use prior to sharing equipment in the past 30 days, or prior to or during sex in the past 90 days, see Table 3.

4. Discussion

Among a cohort of PLHIV in Russia who have ever injected drugs, we detected a statistically significant association between female gender and condomless sex in the past 90 days, even after controlling for the potentially confounding effects of demographics, partner status, and ART use. Although we observed notable associations between gender and other outcomes, including sharing drug equipment, alcohol use prior to sharing, and both drug equipment sharing and condomless sex, the results were not statistically significant, possibly

due to limited power given the relatively small number of women in the study. It is also notable that nearly all risk behaviors, other than alcohol use prior to sharing, appeared to be more commonly reported among women compared to men.

The increased odds of substance using women having condomless sex, compared to men, has been previously documented in multiple settings (29), including St. Petersburg, Russia (30). Prior research from St. Petersburg also found partnership status (i.e., HIV concordance versus HIV discordance) to be a major factor in PWID's decision-making process about whether to engage in condomless sex with their partner (31). In our study, more participants reported being in HIV concordant partnerships (versus HIV discordant partnerships) which could explain why such a high proportion of respondents engaged in condomless sex. Regardless, female participants had higher odds of reporting condomless sex, irrespective of their partner's HIV status, posing risk for HIV transmission in this population. Further, the preventive health benefits of HIV-positive persons using a condom or other protective barrier during vaginal or anal sex are indisputable, regardless of their partner's HIV serostatus. These results are particularly concerning in light of recent research suggesting heterosexual transmission of HIV is increasing in St. Petersburg, and may overtake injection drug use as the primary mode of transmission (32), and suggest a need for a comprehensive, multi-pronged response which should include “treatment as prevention” (TasP) (i.e. ART for HIV-positive partners to achieve viral suppression and reduce transmission) (33) and pre-exposure prophylaxis (PrEP) for HIV-negative partners (34). Interventions promoting condom usage are also warranted. However, our finding that women were less likely than men to use condoms under all circumstances implies that such approaches must be designed to account for the social, micro, and macro contexts of women's lives. At the relationship level, alcohol use prior to sex was common and may have interfered with condom decision-making around the time of the sexual event. Connecting women (and their partners) to alcohol harm reduction programming could help to lessen their collective risk for HIV infection and transmission (35).

Our findings support the value of implementing multi-level interventions and also imply that TasP is a high-yield approach with potential to reduce the risk of transmission with condomless sex, as well as provide a multitude of other health benefits for the HIV-positive individual. Addressing the social and structural factors (inequality in socio-economic status, intimate partner violence, etc.) that contribute to gender differences in condom usage, and providing HIV-negative women with access to PrEP (which may provide protection in settings where condoms cannot be used) are additional strategies which should also be pursued.

As has also been seen in other settings, (30) women in our study were more likely to report drug equipment sharing than men. However, it seems the relationship between female gender and equipment sharing is at least partially explained by demographics, most notably employment and income. Female participants in this study were significantly less likely to be employed than male participants (31% vs. 49%, $p<0.01$) and significantly more likely to earn a monthly income below the sample median of 20,000 Rubles (68% vs. 44%, $p<0.01$). When there is limited access to clean needles and syringes and/or limited funds to pay for new/unused equipment, women may be more likely to share (relative to men). This could be

the result of the woman having less (or no) money to pay for the drugs/supplies. These patterns have been observed in other populations, including among PWID in South Africa where more women (26%) than men (13%) reported always sharing injecting equipment (36). Low economic status, coupled with limited work opportunities for women, have also been associated with increased sexual risk taking among female (versus male) substance users, including having multiple sex partners and relying on sex trade/transactional sex to support drug use. Findings from the 2009 National HIV Behavioral Surveillance System, conducted in 20 U.S. cities, suggest more female (versus male) PWID have sex in exchange for money or drugs (31% and 18%, respectively) (37). Findings from Russia found that compared to their male counterparts, female injectors who reported high drug use frequency were more likely to also report multiple sex partners (38). Our findings highlight the need for free access to clean needles/syringes among women who inject drugs, as well as access to opiate agonist therapy to prevent HIV (39).

4.1 Limitations

Our study has limitations. The sample size was relatively modest and participants were predominantly male, which limited study power particularly for outcomes that were less common (i.e. drug risk behaviors). These findings from Russia might not be representative of the relationship between female gender and HIV transmission risk among people who inject drugs or have a history of injection drug use, who are living with HIV in other non-Russian settings, or even within Russia but outside of the Russia ARCH study population. Additionally, our research was done with a mixed sample of current and former injection drug users.

Another limitation of the current study is that knowledge and perceptions surrounding risk of HIV transmission were not assessed, nor did we specifically explore several key mechanisms known to contribute to sex and drug use behaviors associated with increased risk for HIV transmission. For instance, participants were not asked about their experiences of intimate partner violence, despite that it has been associated with women's reduced ability to negotiate condom use and talk about HIV prevention with their partner (40). Intimate partner violence is also a correlate of drug use and harmful alcohol consumption (41). More research is needed to understand the challenges and preferences of HIV-positive women who inject (or have a history of injecting) drugs, which may be contributing to their condom nonuse and harmful drug and alcohol consumption. A better understanding of the factors underlying women's condom choices, or to what extent they have any choice in the matter, will inform the design of more meaningful and effective prevention strategies. Furthermore, assessing awareness and willingness to use PrEP among HIV-negative women and men who have ever injected drugs or have a known HIV-positive partner is needed to inform future efforts for HIV prevention.

We also did not assess participants' sexual orientation or gender identity, or these characteristics of their sexual partner(s). Further, we did not assess differences in drug use and sexual behaviors according to whether the partner under consideration was a long-term or casual partner (or a sex worker or stranger). Nor did we measure partner-specific information on sexual or drug related behaviors of interest (i.e., that could assess behaviors

occurring at the partner-level). Instead, we only measured behaviors of interest at the individual level. These details should be collected in future research, as understanding partner dynamics contextualizing most at risk situations will help to establish what is needed for prevention efforts.

All behavioral measures were self-reported and thus subject to recall and/or social desirability biases. Additionally, different timeframes were used for the outcomes (e.g., some measured past 30 days while others measured past 90 days) which may have differentially impacted participants' ability to accurately remember their true behaviors. However, the Russia ARCH cohort study team is skilled at interviewing and has extensive experience with this population which likely serves to mitigate this latter bias.

5. Conclusions

Notwithstanding these limitations, this study's findings add to the understanding of the way in which gender differences in risk behaviors exist among PLHIV who have ever injected drugs in Russia, and offer insights about women's heightened HIV transmission risk in this population. Improved knowledge about HIV risk behaviors among both women and men who are living with HIV and inject drugs, or have a history of doing so, can support more gender-tailored HIV interventions. Further, our results imply that strategies are greatly needed in Russia to develop HIV prevention, diagnosis and treatment interventions that take into account the influence of sexual behavior and gender. Understanding the way in which gender influences whether PLHIV who have ever injected drugs engage in condomless sex, and implementing strategies that do not solely rely on condom use (such as TasP and PrEP), may lead to more effective HIV control in key populations in Russia and beyond.

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Table I

Baseline demographics, CD4 cell count and substance use overall and by gender among HIV-positive people who have ever injected drugs in Russia ARCH, St. Petersburg (n=291)

Measure	Overall N (%)	Female N (%)	Male N (%)	p-value
Total	**291**	**74 (25.4)**	**217 (74.5)**	
Mean age (SD)	33.4 (4.7)	31.5 (4.2)	34.1 (4.8)	<0.01
Education beyond primary (>9th grade)	228 (78.4)	56 (75.7)	172 (79.3)	0.52
Employed	130 (44.7)	23 (31.1)	107 (49.3)	0.01
Median monthly income in Rubles (IQR)	20,000 (5,000-30000)	10,000 (4,000-20,000)	20,000 (10,000-30,000)	<0.01
Income below median	144 (49.7)	50 (67.6)	94 (43.5)	<0.01
Partnered	142 (48.8)	49 (66.2)	93 (42.9)	<0.01
Partner HIV status				
HIV-negative	51 (17.5)	12 (16.2)	39 (18.0)	<0.01
HIV-positive	91 (31.3)	37 (50.0)	54 (24.9)	
No partner	149 (51.2)	25 (33.8)	124 (57.1)	
Mean CD4 count (SD)	525.1 (305.9)	561.0 (368.2)	512.2 (280.6)	0.32
Opioid and/or Heroin use in past 30 days	118 (40.5)	33 (44.6)	85 (39.2)	0.41
Past 30-day injection drug use	127 (43.6)	34 (45.9)	93 (42.9)	0.64
Among those with past 30 day injection dru	g use: drugs injec	ted		
Heroin and stimulants	18 (14.2)	6 (17.6)	12 (12.9)	0.75
Only heroin	96 (75.6%)	25 (73.5%)	71 (76.3%)	
Only stimulants	10 (7.9%)	3 (8.8%)	7 (7.5%)	
Neither	3 (2.4%)	0 (0.0%)	3 (3.2%)	
Cannabis use in past 30 days	48 (16.5)	8 (10.8)	40 (18.4)	0.13
Heavy alcohol use in past 30 days	205 (70.4)	58 (78.4)	147 (67.7)	0.08
Transactional sex in past 12 months				
Gave money, drugs or alcohol in exchange for sex	30 (10.5%)	0 (0.0%)	30 (14.0%)	
Received money, drugs or alcohol in exchange for sex	4 (1.4%)	3 (4.2%)	1 (0.5%)	<0.01
Gave AND received money, drugs or alcohol in exchange for sex	6 (2.1%)	1 (1.4%)	5 (2.3%)	
None reported	247 (86.1%)	68 (94.4%)	179 (83.3%)	

Table II

Primary and secondary outcomes at baseline, 12 and 24-month follow-up; and ART use at 12 and 24-month follow-up, overall and by gender, among HIV-positive people who have ever injected drugs in Russia ARCH, St. Petersburg (n=291)

Measure		Overall No./N (%)	Female no./N (%)	Male no./N (%)
Primary Outcomes				
Sharing drug equipment past 30 days				
	Baseline	50/287 (17.4)	16/72 (22.2)	34/215 (15.8)
	12 months	35/186 (18.8)	15/50 (30.0)	20/136 (14.7)
	24 months	28/133 (21.1)	11/36 (30.6)	17/97 (17.5)
Condomless sex past 90 days				
	Baseline	133/280 (47.5)	49/70 (70.0)	84/210 (40.0)
	12 months	80/179 (44.7)	28/49 (57.1)	52/130 (40.0)
	24 months	59/127 (46.5)	21/34 (61.8)	38/93 (40.9)
Secondary Outcomes				
Alcohol use prior to sharing past 30 days				
	Baseline	25/287 (8.7)	7/72 (9.7)	18/215 (8.4)
	12 months	13/186 (7.0)	2/50 (4.0)	11/136 (8.1)
	24 months	8/133 (6.0)	4/36 (11.1)	4/97 (4.1)
Alcohol use before or during sex past 90 days				
	Baseline	158/287 (55.2)	45/71 (63.4)	113/215 (52.6)
	12 months	79/181 (43.6)	26/50 (52.0)	53/131 (40.5)
	24 months	60/131 (45.8)	18/36 (50.0)	42/95 (44.2)
Both drug equipment sharing & unprotected sex				
	Baseline	30/280 (10.7)	13/70 (18.6)	17/210 (8.1)
	12 months	17/179 (9.5)	8/49 (16.3)	9/130 (6.9)
	24 months	13/127 (10.2)	8/34 (23.5)	5/93 (5.4)
ART use in the past 6 months				
	12 months	32/186 (17.2)	10/50 (20.0)	22/136 (16.2)
	24 months	46/133 (34.6)	11/36 (30.1)	35/97 (36.1)

Table III

Unadjusted, partially and fully adjusted relative odds for HIV risk behaviors associated with female gender among HIV-positive people who have ever injected drugs in Russia ARCH, St. Petersburg (GEE model results)

Risk Behaviors	Unadjusted Model OR (95% CI)	p-value	Partially Adjusted Model aOR[a] (95% CI)	p-value	Final Model aOR[b] (95% CI)	p-value
Primary Outcomes						
Sharing drug equipment past 30 days	**1.92 (1.16-3.18)**	**0.01**	1.53 (0.89-2.62)	0.12	1.45 (0.85-2.46)	0.18
Condomless sex past 90 days	**2.65 (1.69-4.15)**	**<0.01**	**2.73 (1.67-4.48)**	**<0.01**	**1.91 (1.12-3.23)**	**0.02**
Secondary Outcomes						
Alcohol use prior to sharing past 30 days	1.13 (0.52-2.44)	0.76	0.79 (0.34-1.81)	0.57	0.61 (0.25-1.47)	0.27
Alcohol use before or during sex past 90 days	1.47 (0.92-2.33)	0.11	1.46 (0.89-2.42)	0.14	1.16 (0.70-1.92)	0.56
Both drug equipment sharing & unprotected sex	**3.03 (1.65-5.63)**	**<0.01**	**2.45 (1.33-4.52)**	**<0.01**	1.68 (0.89-3.19)	0.11

[a] Adjusted for demographics, including age, education, and income

[b] Adjusted for demographics, partnered status (non-partnered, partnered HIV discordant, partnered HIV concordant) and ART use in the past 6 months